Data Analysis and Instrument Performance Assessment for Regional Carbon Flux Estimates

Completed Technology Project (2016 - 2017)

Project Introduction

The initial test and science flights of the Sherpa airborne system for direct greenhouse gas (GHG) flux measurements were completed in September 2016. Here we plan to continue work on the flux data analysis and to assess the performance of the system instrumentation under support from the IRAD. The objectives are to produce science-quality flux data products including quantitative uncertainty bounds, to evaluate instrument performance with respect to flux measurement requirements, and to document lessons learned from the first flight series.

The overall objective of the activity is to assemble a NASA airborne system for eddy covariance measurements of regional GHG fluxes and to use this system to obtain GHG flux data for a range of ecosystem states and land use regions. Such measurements are needed to evaluate CO_2 and CH_4 top-down and bottom-up source and sink estimates. These observations will validate top-level OCO-2 products and those from other space-based GHG missions, while testing and improving parameterization of biogeophysical flux models. In-flight demonstration of the flux measurement is necessary to mature the system TRL.

The innovative elements in the proposed work are: 1) to modify commercial off-the-shelf instrumentation into a new capacity for direct airborne flux measurement and 2) to enable development of a GHG flux measurement facility that will provide a new tool for NASA science. Although the eddy covariance technique is well established, historically NASA has had limited involvement in these measurements. The specific objective of this proposal is to document and further improve the performance of the airborne flux measurement system through post-flight analysis, as needed for securing future support.

Anticipated Benefits

This study benefits existing missions like OCO-2 and future ASCENDS missions.

The Greenhouse Gas Measurement system is shown mounted in a rack on the C-23 Sherpa. The System includes measurements for CH4, CO2, and H2O.

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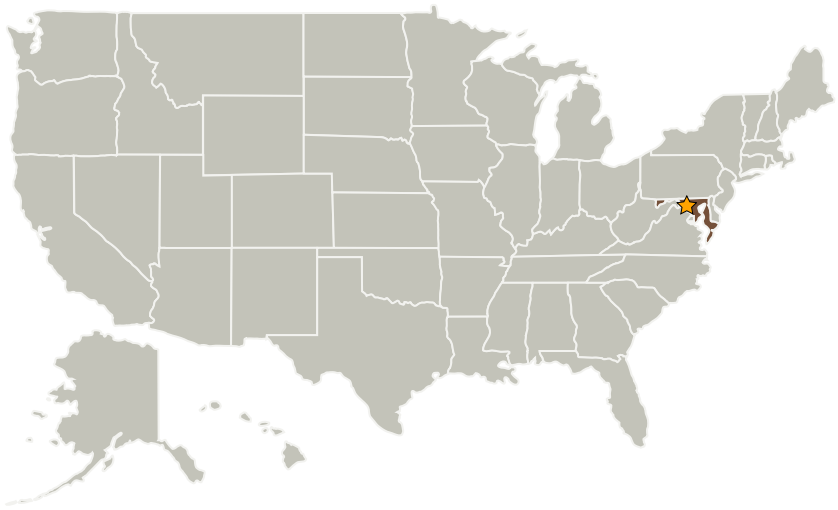
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Project Transitions

October 2016: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Matthew J Mcgill
William E Cutlip

Principal Investigator:

Stephan R Kawa

Co-Investigators:

Paul Newman
Glenn M Wolfe

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October 2017: Closed out

Closeout Summary: The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services.Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry.The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies.If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. http://techport.nasa.gov/help

Images

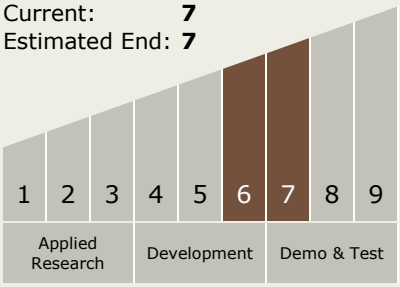
Greenhouse Gas Flux Measurement System
The Greenhouse Gas Measurement system is shown mounted in a rack on the C-23 Sherpa. The System includes measurements for CH4, CO2, and H2O.
(https://techport.nasa.gov/image/26328)

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Technology Maturity (TRL)

Start: **6**
Current: **7**
Estimated End: **7**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

Target Destination

Earth